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THE

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THE NOMENCLATURE OF FELDSPATHIC GRANOLITES.[1]

MOST petrographers agree that the classification of granular rocks, if not of lavas, should be based on mineral composition. This resolves itself practically into the molecular composition. When we state that a rock is composed of quartz, mica, and orthoclase in certain definite proportions, we state the relative proportions of the molecules of which these minerals are composed, and this is true of all other minerals which are made up of a single molecule. But when we introduce terms such as plagioclase, which is composed of two molecules in ever varying proportions, we no longer treat of molecules as such, but of mixtures of molecules. It seems quite clear that the molecular method should be applied throughout, when practicable, and in calculating the composition of the feldspathic rocks the plagioclase should be resolved into the constituent albite[2] and anorthite molecules, and the term *plagioclase* should not be used. This is particularly necessary with monzonites and diorites, for it is clear that if we define typical monzonite as a rock composed of equal quantities of orthoclase and soda-lime feldspar, we may have orthoclase with basic labradorite, although that must be rare, or, orthoclase with acid oligoclase. The nature of these two rocks would be so different as certainly to make us hesitate to designate them by the same name. In the feldspathic rocks it seems to me proper to base the classification of these rocks primarily on the feldspars, and if we subdivide the feldspathic rocks on the basis of the ratio of the alkali-feldspar molecules (Or + Ab) to the lime-feldspar molecules (An), the true mineral and, to some extent, the chemical relations of the rocks will be brought out, and I think more correctly classify them than to put the orthoclase, or the alkali-feldspars in apposition to the albite and anorthite molecules combined. In order to graphically represent the position of the various rocks under discussion there is now introduced a table which is self-explanatory. In the column represented in the table we have at one end of the series an alkali-feldspar molecule and at the other end a lime-feldspar molecule, and the feldspars of rocks may be said to be composed of one of these molecules or of isomorphous mixtures of the same. The rocks at the head of the column containing feldspars composed chiefly of orthoclase and albite may be designated as orthosite (from the French term orthose = orthoclase) when orthoclase chiefly is present; as anorthosite,[3] when anorthoclase chiefly is present, and as albitite when albite chiefly is present. The rock at the foot of the column, whose feldspathic constituent is largely anorthite, may be designated anorthitite.

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[2] We may treat the soda of the feldspars all as in albite, although some of it may be in the orthoclase.

It is impracticable at the present time, and, for the purpose of this paper, unnecessary to consider the position in this column of all the feldspathic granolites; a sufficient number, however, are introduced to show the result of the method here proposed, as follows:

Albitite-porphyry or *soda-syenite-porphyry.* — No. 1521 Sierra Nevada. Turner. Seventeenth Ann. Rept. U. S. Geol. Surv., Part I, p. 727. Composed

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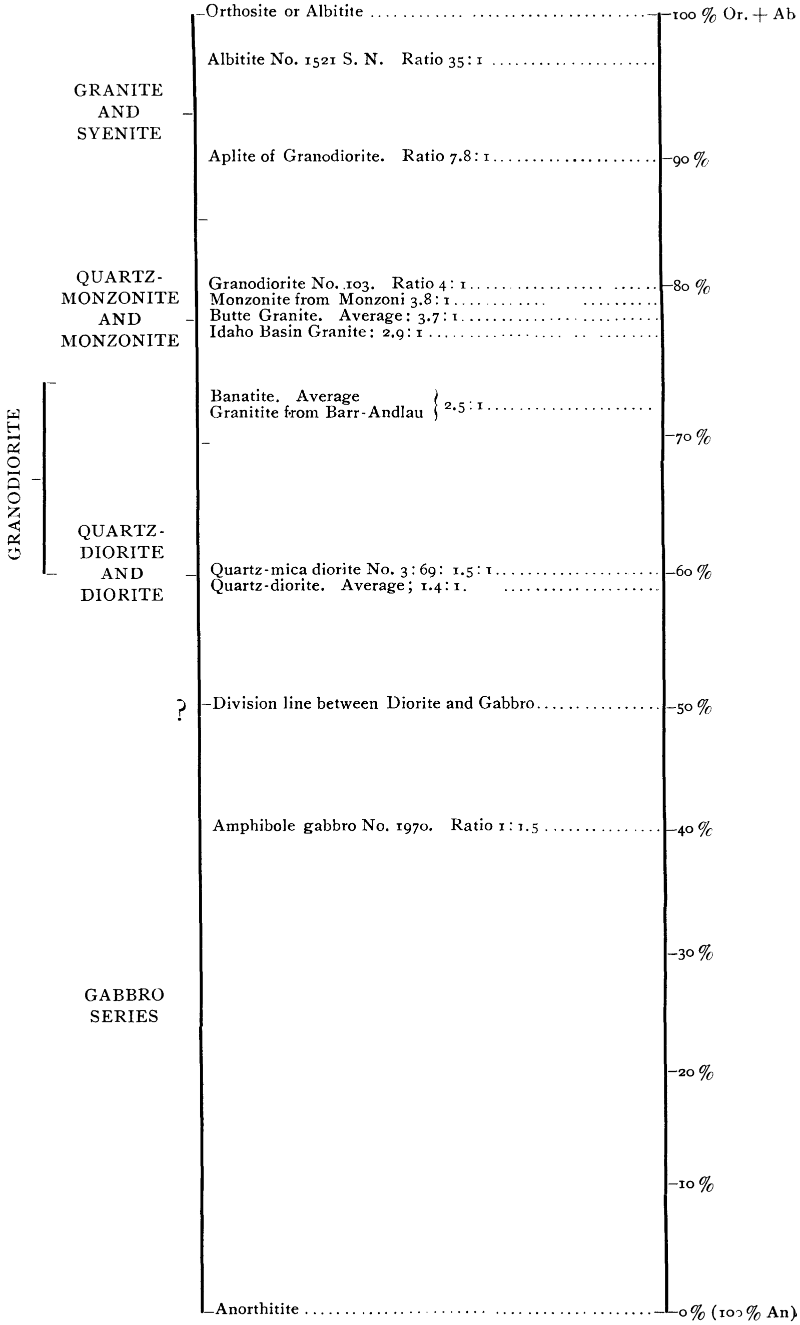
[3] The use of this term will be at once objected to by petrographers since it has already been used for rocks composed largely of labradorite and more basic feldspars. It is a question, however, since the term in this sense is a misnomer, if it would not be well to drop it.


GRANITE AND SYENITE
QUARTZ-MONZONITE AND MONZONITE
GRANODIORITE
QUARTZ-DIORITE AND DIORITE
?
GABBRO SERIES
Orthosite or Albitite
Albitite No. 1521 S. N. Ratio 35:1
Aplite of Granodiorite. Ratio 7.8:1
Granodiorite No. 103. Ratio 4:1
Monzonite from Monzoni 3.8:1
Butte Granite. Average: 3.7:1
Idaho Basin Granite: 2.9:1
Banatite. Average
Granitite from Barr-Andlau
2.5:1
Quartz-mica diorite No. 3:69: 1.5:1
Quartz-diorite. Average; 1.4:1.
Division line between Diorite and Gabbro
Amphibole gabbro No. 1970. Ratio 1:1.5
Anorthitite
100 % Or. + Ab
90 %
80 %
70 %
60 %
50 %
40 %
30 %
20 %
10 %
0 % (100 % An)

chiefly of albite with some aegerite (?). Ratio of the orthoclase and albite molecules combined, to the anorthite molecules, 35 : 1.

Aplite.—Average of two analyses of aplites from dikes in the Sierra Nevada granodiorites. Composed of quartz> orthoclase> albite> anorthite. JOUR. GEOL., Vol. VII, 1899, p. 160. Ratio, 7.8 : 1. This is the most alkali rich granite in the Sierra Nevada. The amounts of feldspars here given are the result of a more exact calculation, and differ somewhat from the amounts given in the paper referred to. The biotite-granite of my former paper is in reality a quartz-monzonite, and its molecular composition likewise requires some revision.

Granodiorite.—Lindgren. No. 103, Pyramid Peak. Amer. Jour. Sci., Vol. III, April 1897, pp. 306 and 310. Ratio, 4 : 1. Composed of orthoclase> quartz> albite> anorthite.

Monzonite.—Brögger, from Monzoni, described by him on page 24 of "Die Eruptionsfolge der triadischen Eruptivgesteine bei Predazzo in Süd-tyrol," with a ratio of 3.8 : 1. Composed of orthoclase> albite> pyroxene> anorthite> lepidomelane> hornblende> magnetite> quartz> apatite, zircon, etc. This is taken as Brögger's typical monzonite.

Butte-granite or *quartz-monzonite.*—Weed. JOUR. GEOL., Vol. VII, 1899, pp. 739 and 744. Average of four analyses of the granitic rock at Butte, Montana. Ratio, 3.7 : 1. Composed of quartz> albite> orthoclase> hornblende> anorthite> biotite, titanite, and apatite.

Idaho Basin granite.—Lindgren. Eighteenth Ann. Rept. U. S. Geol. Surv., Part III, pp. 640–641. Ratio, 2.9 : 1. Composed of albite> quartz> anorthite> orthoclase> hyalophane, apatite, titanite, magnetite, and calcite.

Banatite.—Brögger. Average of analyses of five banatites. JOUR. GEOL., Vol. VII, p. 149. The potash and soda given in the paper referred to are interchanged in both the average of the banatites and of the adamellites. Ratio, 2.5 : 1. Calculation approximate.

Granitite.—From Barr-Andlau. Rosenbusch. Die Steiger-Schiefer. Abhandlungen zur geologischen Specialkarte von Elsass-Lothringen, Vol. I, pp. 147–148. Ratio, 2.5 : 1. This appears to be the rock referred to by Brögger on page 62 of his paper on the Monzoni rocks. He states that it contains 35.5 per cent. of orthoclase; 31.5 per cent. plagioclase ($Ab_2 An_3$); 24 per cent. quartz; and 10 per cent. magnesia-mica. Rosenbusch, however, in the paper above referred to states that this granitite contains about 27 per cent. orthoclase, 40 per cent. plagioclase, 24 per cent. quartz, and 10 per cent. magnesia-mica. The rock represented in the table below, therefore, is Rosenbusch's Barr-Andlau rock, and not the rock discussed by Brögger on page 62 of his paper.

Quartz-mica-diorite or *basic granodiorite.*—Turner. Seventeenth Ann. Rept. U. S. Geol. Surv., Part I, p. 724. Rocks of this type are to be found

ALKALI AND LIME CONTENTS OF FELDSPATHIC GRANOLITES.

Name following new scheme	Albitite-porphyry	Granite or Aplite	Quartz-monzonites and monzonites						Quartz-diorite		Amphibole-gabbro
Original name of author........	Albitite-porphyry, No. 1521 Turner	Aplite Turner	Granodiorite No. 103 Lindgren	Monzonite from Monzoni Brögger	Butte granite average Weed	Idaho Basin granite Lindgren	Banatite, average Brögger	Granitite Barr-Andlau Rosenbusch	Quartz-mica diorite, No. 369 Turner	Quartz-diorite average Turner	Amphibole-gabbro, No. 1970 Turner
K_2O........	.10	5.40	3.66	4.42	4.11	3.02	3.48	4.54	1.76	2.01	.22
N_2O........	11.50	2.74	3.47	3.07	2.76	3.57	3.57	2.46	3.49	3.07	2.75
CaO........	.55	1.49	3.60	8.50	4.20	3.85	4.15	3.81	5.49	6.00	13.02

PERCENTAGE WEIGHTS OF THE FELDSPAR MOLECULES AND THEIR RATIOS.

Orthoclase...	.56	31.41	17.75	30.00	19.88	10.06	20.57	26.98	10.01	11.12	1.28
Albite.......	96.94	23.16	29.41	19.20	22.98	30.25	29.87	20.94	28.34	25.68	22.53
	97.50	54.57	47.16	49.20	42.86	40.31	50.44	47.92	38.35	36.80	23.81
Anorthite....	2.78	7.00	11.91	12.80	11.48	13.88	20.57	19.04	25.02	27.80	36.58
Ratio of Or + Ab : An.	35 : 1	7.8 : 1	4 : 1	3.8 : 1	3.7 : 1	2.9 : 1	2.5 : 1	2.5 : 1	1.5 : 1	1.4 : 1	1 : 1.5

at a great number of points in the granodiorite areas of the Sierra Nevada. Ratio, 1.5 : 1. Composed of albite> anorthite> quartz> orthoclase><biotite, amphibole, etc. Calculation approximate.

Quartz-diorite.—Turner. Average of five analyses of quartz-diorite from the Sierra Nevada. JOUR. GEOL., Vol. VII, 1899, p. 149. Ratio, 1.4 : 1. Composed of anorthite> albite> quartz> = orthoclase. In most of the quartz-diorites there are biotite, hornblende, and accessory minerals present. Calculation approximate.

Amphibole-gabbro.—No. 1970 Sierra Nevada. Turner. Am. Jour. Sci. Vol. VII, 1899, p. 297. Ratio, 1 : 1.5. Composed of amphibole> anorthite> albite> orthoclase. There are also present magnetite, pyrite, and pyrrhotite. Calculation approximate.

Taking the monozite from Monzoni as a typical mozonite with a ratio of $(Or + Ab)_{3.8} : An_1$ it is clear that if we accept the method here proposed the granodiorite No. 103, the Butte granite, and the Idaho Basin granite are properly quartz-monzonites. If we likewise place the banatites with quartz-monzonites, then the granitite from Barr-Andlau, and many of the granodiorites of the Sierra Nevada will likewise be quartz-monzonites.

The use of mineralogical terms in naming granolites of simple composition seems to me very desirable, although it is not practicable with rocks of complex composition. This can be done with most feldspathic types as follows:

Orthosite	composed	chiefly	of	orthoclase
Anorthosite	"	"	"	anorthoclase
Albitite	"	"	"	albite
Oligosite	"	"	"	oligoclase
Andesinite	"	"	"	andesine
Labradite	"	"	"	labradorite
Anorthitite	"	"	"	anorthite

By the addition of abundant and essential quartz to the above ingredients we have appropriate names for the quartz-granolites as follows: quartz-orthosite or granite in its restricted use, quartz-andesinite, quartz-labradite, etc. In all the above cases the quartz is an essential and not an accessory ingredient. When accessory constituents are used in naming rocks the word should, it seems to me, have the adjective form, as *quartziferous syenite* for a syenite containing some quartz. If such a scheme came into general use the term *granite* would still be a useful one for nearly all quartz-feldspar rocks, in which sense it is used by Michel Lévy and by many other geologists.

H. W. TURNER.